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ABSTRACT

The use of gestures by four infants was recorded as they interacted with their mothers. Waving, extending objects, and headshaking generally achieved a threshold of at least 10 instances within one month of acquisition. Both waving and headshaking were often first used in imitative and game routines with the mother before they became communicative. Mothers exhibited a high rate of response to the children's performative gestures, the response often consisting of the appropriate performative word. Of the three object-related gestures observed, extending objects and open-handed reaching were not imitative, though they always occurred as responses to maternal behavior, while pointing developed initially as a spontaneous rather than a responsive gesture. These last three gestures became communicative later than the others, apparently because the former require coordination of two actions, directed at the mother and at the object. The infants did not use conventional words with gestures until after they had demonstrated this ability to coordinate two nonverbal signals. An analysis of maternal responses indicated a sensitivity to developmental phases of communicative gesturing: in addition, the responses facilitated the children's transition from gestural to verbal communication. (JB)

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THE DEVELOPMENT OF COMMUNICATIVE GESTURES IN MOTHER-INFANT INTERACTIONS

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Although researchers have often mentioned the frequency with which gestures accompany children's first words (e.g., Dore, 1974), only recently have they begun to explore the acquisition of these gestures and their communicative use and to inquire into the role they may play in children's transition to early verbal communication. Bruner (1975) and Bates and her colleagues (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1977; 1979; Bates, Camaioni, & Volterra, 1975) have emphasized the functional continuity between prelinguistic and initial linguistic signaling, suggesting that young children's early communicative intentions may be expressed gesturally before they can be encoded in conventional verbal symbols. For example, the open-handed reach toward an object can be considered a "proto-imperative" (Bates et al., 1977). Bates, Camaioni, and Volterra (1975) concluded that one category of early utterances, performatives such as hi and bye-bye, must have developed before speech through the use of gestures and nonverbal vocal signals since these performatives are so clearly established in children's first verbal utterances. Carter (1975) has also traced the development of some lexical items, such as here and there, in the speech of one child to their origins in vocal-gestural routines, including reaching for and extending objects to others.

The role parents, especially mothers, may play in the development of gestures and in the transition from gestural to verbal communication has just begun to be considered. Ryan (1974) has argued for more research on early communicative intentions expressed by preverbal children through gestures and on the role parents play in interpreting and responding to these early communicative attempts.

This paper investigates the emergence and development of a variety of communicative gestures by four infants during natural interactions with their mothers, examining the influence of both cognitive and interactional factors on gestural development and the transition to verbal communication.

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Method

Subjects and Procedure

Four first-born middle-class infants, two girls and two boys, were videotaped in their homes in interaction with their mothers, who were their primary caretakers. The videotaping took place during a consistent set of behavioral episodes centering around the infants' baths and usually including other caretaking activities and interactive play. The subjects were participants in a longitudinal naturalistic study[1] of development that involved one half hour of videotaping beginning before the infants were three months old. For this study, the tapes of the infants made at monthly intervals, starting from 9 months for the children referred to as Carol, Joel, and Allen and from 8 months for the child called Jean and continuing through 18 months, were analyzed.

Gestural Transcription

The following gestures were transcribed from the videotapes: Pointing at an object (pointing at pictures was specifically omitted); extending an object toward the mother; open-handed reaching toward an object; headshaking; and waving. For each gesture the following information was also recorded: the object involved; the direction of the child's gaze; any accompanying vocalization or conventional word; and the mother's action or speech in eliciting or responding to the gesture. Interobserver reliability for two researchers on identifying and transcribing these gestures and their characteristics averaged 92%.

The mothers' verbal responses were also examined to determine whether they included the name of the object involved; the performative word appropriate to the gesture, such as hi or bye-bye with waving or no with headshaking; or a repetition of the child's word. Reliability for two coders averaged 95%.

Criteria for Gestural Acquisition and Communicativeness

The criterion for the acquisition of a gesture was set at three instances during one month. Following Bates et al. (1975), we examined whether the gestures were "communicative." For this study, gestures were judged communicative if they met any of the following criteria: the child's gaze was directed toward the mother; the child's gaze was directed toward the camera which was not the object involved; the gesture was accompanied by a conventional word or another gesture; or the gesture was an appropriate response to the mother's speech or behavior and not an imitation or game. Appropriate responses to

the mother's speech included answers to questions and compliance with requests for action, such as pointing in response to Where is your ball?, while appropriate responses to the mother's behavior included such examples as extending objects following a palm up, arm-extended requesting gesture. Intercoder reliability for judgments of communicativeness averaged 90%.

Results and Discussion

Despite variations in amount of production and rate of acquisition, there were consistent patterns in the children's orders of gestural development and in the relationships between their gestural production and their mothers' eliciting and responding behaviors. Table 1 displays the months that the children achieved criterion on each of the gestures. Waving, extending objects, and headshaking generally achieved a threshold of at least 10 instances or 50% communicative within one month of acquisition. The only exception, Joel, did not produce any waves at 11 months. Waving and extending objects, the two gestures which became communicative earliest, allow gaze and gesture to be directed to the same goal, the mother. This may account for their early achievement of "communicativeness," a question discussed below.

Both waving and headshaking were often first used in imitative and game routines with the mother before they became communicative. This was true for all instances of waving for Jean at 8 months and all but one instance for Joel at 10 months. Allen's only instance of a wave, not sufficient to reach criterion, was an imitation at 12 months. Carol at 9 months had already mastered the communicative use of this gesture. In addition, 50% of Jean's and 78% of Carol's first headshakes were in the context of imitative games also. It appears, then, that waving and headshaking tended to arise for these three children in elicited game routines.

Table 2 records the high rate of maternal responses to the children's performative gestures for all months combined. About 80% of all headshaking and 60% of all waving gestures received responses. Responses to waving the month criterion was achieved, however, were higher, averaging 82% for the three children. This reflects the reciprocal nature of the early imitative games. Later waves were frequently addressed to the camera operator and more likely to be missed by the mothers.

When waves and headshakes were acknowledged by the mothers, it was likely to be with the appropriate performative word. The high percentages of responses including performative words to Joel's waving and Carol's headshaking elicited the children's own production of these performatives. Joel imitated bye-bye at 10 months after his mother said it twice in a row. Similarly, Carol produced an imitation

Table 1
Acquisition of Five Communicative Gestures

Total N	Gesture	Month Criterion Achieved	Month at least 10 Instances or 50% Communicative	Month Words First Accompany Gestures
	Waving			
19	Jean	8	9	13
17	Carol	9	9	17
6	Joel	10	12	10[a]
—	Allen	—	--	--
	Extending Object			
162	Jean	9	10	13
74	Carol	13	13	15
26	Joel	13	13	17
26	Allen	12	12	16
	Headshaking			
45	Jean	13	14	13
21	Carol	12	13	12
25	Joel	14	14	15
—	Allen	--	--	—
	Pointing			
139	Jean	9	13	13
55	Carol	14	14	14
61	Joel	13	14	16
23	Allen	14	16	16
	Open-Handed Reaching			
86	Jean	8	16	15
37	Carol	9	15	17
104	Joel	10	14	15
79	Allen	9	15[b]	16

[a] [ba ba], an imitation of bye-bye during a game.

[b] The "communicative" open-handed reaching was all to his mother.

Table 2

Mothers' Responses to their Children's Gestures of Waving and Headshaking

A. Percentages of Gestures Responded to:

	Waving	Headshaking
Jean	58	84
Carol	59	76
Joel	67	84
M	61	81

B. Percentages of Mothers' Responses including their Children's Words, hi, bye-bye, or no:

	Waving	Headshaking
Jean	73	71
Carol	70	94
Joel	100	19

Table 3

Mothers' Responses to their Children's Gestures of Extending Objects, Pointing, and Open-Handed Reaching

A. Percentages of Gestures Responded to:

	Extending Objects	Pointing	Open-Handed Reaching
Jean	92	80	66
Carol	92	67	65
Joel	100	84	67
Allen	100	65	58
M	96	74	64

* ***

B. Percentages of Mothers' Responses including the Names of the Objects Involved:

	Extending Objects	Pointing	Open-Handed Reaching
Jean	11	50	19
Carol	40	59	21
Joel	27	55	17
Allen	15	33	13
M	23	49	18

** ***

* $p < .05$ ** $p < .02$ *** $p < .01$

of no no at 12 months with her headshake after her mother had said the word and shaken her own head six times in a row.

The remaining three gestures, extending objects, pointing, and open-handed reaching all involve the use of objects. None of these emerged from an imitative context, although extending objects and open-handed reaching occurred as responses to maternal behaviors from the beginning. Pointing, in contrast, developed initially almost exclusively as a spontaneous rather than responsive gesture, without any eliciting behaviors on the part of the mothers, suggesting a self-directing attentional function of early pointing.

Pointing and open-handed reaching became communicative later than the other gestures, although they often achieved criterion early. To qualify as communicative, except in the infrequent cases where the mother holds or is the object (e.g., Allen's reaching at 15 months), both gestures require an ability to coordinate two directions, looking toward the mother and gesturing toward another object. Bates et al. (1979) discussed the child's ability to alternate his gaze between the object and his conversational partner as an indication of the child's intentionality in communicating, his awareness "of the effects that his signals will have as he emits them" (p. 35). The development of this capacity, they suggested, may be based on the child's underlying cognitive development in the realm of means-ends relationships.

An additional perspective on this issue comes from experimental investigations of infants' abilities, and inabilities, to attend to and produce two simultaneous nonverbal signals, one gestural and the other visual. In Macnamara's (1977) studies, 12-month-olds, but not 17-month-olds, had difficulty in attending to two simultaneous but divergent signals--gesture and visual regard. Murphy and Messer (1977) found 9-month-olds capable of following a point and looking at an object only when the gesturer's hand and the object were in the same visual field. The infants could not, however, follow points directed across their midlines; that task would require attention toward two separate goals or directions and perhaps an ability to infer the visual perspective of the gesturer. Some 14-month-olds had acquired that ability. A study by Lempers, Flavell, and Flavell (1977) also found parallel developmental progressions between the ages of 12 and 18 months in children's productive and receptive abilities in coordinating two spatial perspectives and inferring the perceptions of another.

These studies all indicate that between the ages of 12 and 18 months infants are developing the capacities to coordinate dual spatial orientations, both in the signals they send and in the ones they interpret. To point toward an object and simultaneously look toward

the mother is essentially to send two coordinated but divergent signals. That ability developed later in this sample of four children, as evidenced by the months pointing and reaching became communicative, than did the conceptually simpler waving and extending objects while looking in the same direction at the mother.

We then examined the data for other indications of the children's abilities to send two signals, such as pairing a conventional word with a gesture. Except for two previously cited instances of imitation, Joel's bye-bye and Carol's no no, no conventional words accompanied gestures until after the children demonstrated the ability to coordinate two nonverbal signals, for example, by gazing at the mother while pointing in a divergent direction toward an object--one criterion of communicative pointing.

How did the mothers respond to these object-oriented gestures? As Table 3 illustrates, the mothers replied to the great majority of their children's gestures. A one-way analysis of variance for related samples revealed significant variation in their rates of responding to different gestures, $F(2, 6) = 31.43$, $p < .01$. Follow-up t tests demonstrated that mothers replied significantly more often when their children extended objects than when they pointed, $t(3) = 4.30$, $p < .05$, or reached, $t(3) = 8.71$, $p < .01$, reflecting the strong demand quality of gestures toward the conversational partner.

We had expected that mothers' responding to pointing and reaching might increase gradually as these gestures became accompanied by communicative gazing. An examination of the mothers' behavior the first months that pointing appeared, however, refuted that hypothesis decisively. Carol's, Joel's, and Allen's mothers each responded to 100% of their first month points, and Jean's mother responded to 13 out of 15, 87%. The first month open-handed reaching appeared, Jean's and Allen's mothers responded to 100% of their gestures, but Carol's and Joel's mothers replied only to 40% and 56%, respectively.

The nature of the mothers' responses varied with the kind of gesture, $F(2, 6) = 22.91$, $p < .01$. Mothers responded differentially to pointing gestures, naming the objects in a significantly greater percentage of their responses to pointing than to either reaching, $t(3) = 7.47$, $p < .01$, or extending objects, $t(3) = 5.33$, $p < .02$. Jean's, Carol's, and Joel's mothers replied to their children's pointing gestures with object labels from the first months the gesture appeared. In contrast, object naming to reaches and to extended objects, with the exception of Carol's mother's, tended to appear only after the children developed dual-directional signaling and words. Allen's mother departed from this pattern by providing an occasional, infrequent object name to extensions and reaches seemingly at random across the months, but her labels to points only started at 17 months. Allen's first referential word to appear with a gesture is eye with a point at 18 months.

Although it is, of course, not possible to attribute cause and effect to these relationships, these findings do demonstrate that the mothers are attuned to the incipient communicative gestures of their children. Furthermore, they provide, especially in the case of pointing, the kind of responses which can facilitate the children's transition from gestural to verbal communication.

Footnote

[1] The author would like to thank the many people who have participated in this longitudinal study, including Mathilda Holzman, Linda Ferrier, JoanneMorse, Kathleen O'Leary, Martha Davis, Stephanie Kalfayan, Deena Pavinato, Beverly Burton, and especially the four children and their mothers.

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